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DOCUMENT-IDENTIFIER: US 6021237 A
TITLE: All-fiber acousto-optic tunable filter

ABPL:
This invention relates to an all-fiber acousto-optic tunable wavelength filter which is useful in optical communications or optical fiber sensor systems. The present invention provides an all-fiber acousto-optic tunable filter, comprising: a length of optical fiber for propagating optical waves; a first mode converting means for selectively converting a core mode of the optical wave propagating in said optical fiber into a cladding mode by means of acoustic wave, depending on the wavelength of the optical wave; and a mode selecting means for selecting one or more mode among the core modes and cladding modes. In the embodiment of the invention, the mode selecting means may be configured to be a length of optical fiber whose jacket is partially stripped and a flexural acoustic wave generator to which electrical signal with a plurality of frequency components is applied. According to the invention, the wavelength filters provides a wide tuning range and can electrically control its filtering feature.

BSPR:
The present invention relates to an acousto-optic tunable filter, more particularly to an all-fiber acousto-optic tunable wavelength filter which is useful in optical communications or optical fiber sensor systems.

BSPR:
The insertion type filter is manufactured by connecting optical fiber to the integrated optical device which integrates filtering structure in an optical crystal or the like. An example of such a device is discussed under the article "Integrated optical acoustically tunable wavelength filter" by J. Frangen et al. in Electronics Letters 1989, Vol. 25, Iss 23, pp. 1583-1584. In the article, acousto-optic tunable filter is manufactured by forming light waveguides on a lithium niobate(LiNbO.sub.3) single crystal substrate. However, in this insertion type filter, optical fiber should be connected to integrated optical device, as there is considerable loss at the connected portion, which results in great loss for the passing signal light. Moreover, since some integrated optical devices show significant polarization dependence, the intensity of the output light after passing through the devices may change considerably according to the polarization state of the input light.

BSPR:
Therefore, it is an object of the present invention to provide an acousto-optic tunable filter capable of electrically controlling the transmittance characteristic of the filter at its central wavelength or within its operating wavelength band.

BSPR:
In order to accomplish the aforementioned object, the present invention provides an all-fiber acousto-optic tunable filter, comprising:

DRPR:
FIG. 1 is a schematic view showing the structure of acousto-optic tunable filter according to the embodiment of the present invention;

DRPR:

FIGS. 2(A)-(B) is a graph showing the coupling and transmittance of the acousto-optic tunable filter according to the embodiment of the present invention;

DRPR:
FIG. 3 is a graph showing the transmittance of the acousto-optic tunable filter according to the embodiment of the present invention;

DEPR:
FIG. 1 is a schematic view showing the structure of acousto-optic tunable filter according to the embodiment of the present invention.

DEPR:
If electric signal 151 with constant frequency "f" is applied to flexural acoustic wave generator, flexural acoustic wave having the same frequency "f" is generated. The flexural acoustic wave is transferred to optical fiber 122 and propagates along the optical fiber, finally absorbed in acoustic damper 113. The flexural acoustic wave propagating along optical fiber 122 produces periodic microbending along the fiber, resulting in the periodic change of effective refractive index which the optical wave propagating along the optical fiber experiences. The signal light propagating along the fiber in a core mode can be converted to a cladding mode by the change of effective refractive index in the optical fiber.

DEPR:
FIG. 3 is a graph showing the transmittance of the acousto-optic tunable filter according to the embodiment of the present invention when different electric signal frequencies are applied. As shown in FIG. 3, each center wavelength(i.e. wavelength showing maximum attenuation) of the wavelength filter for different electric signals was 1530 nm, 1550 nm and 1570 nm. Therefore the center wavelength of the wavelength filter according to the embodiment is changed by varying the frequency of the electric signal which is applied to the flexural acoustic wave generator.